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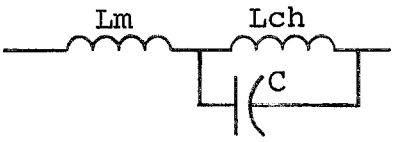
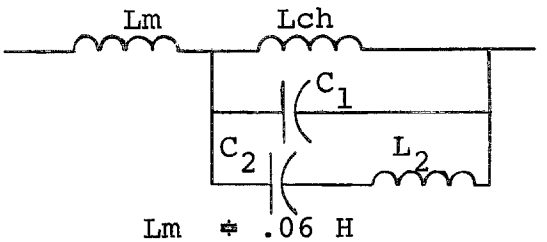
Subject SECOND HARMONIC COMPONENT IN BOOSTER MAGNET CURRENT

It has been acknowledged that a saving of 500 k$ can be realized in the booster rf equipment by the introduction of a second harmonic component in the magnet current.

We have investigated a number of possible circuits and optimized the design with respect to minimum cost. The following gives a comparison of the basic resonance system and the system with the added second harmonic component.

Basic resonance system fundamental only	Same system with added second harmonic component
Magnet current $Im = I_{dc} - \hat{I} \cos wt$	$Im = I_{dc} - \hat{I} \cos wt - \hat{I}/8 \cos(2 wt + 1)$
	
Lm = .06 H Lch = .07 H C = 3479 μF	Lm = .06 H Lch = .07 H C_1 = 2400 μF C_2 = 670 μF L_2 = .06 H
$\hat{E}m$ = 9.7 kJ $\hat{E}ch$ = 9.9 kJ $\hat{E}_c$ = 4.0 kJ	$\hat{E}m$ = 9.7 kJ $\hat{E}ch$ = 9.9 kJ $\hat{E}c_1$ = 3.0 kJ $\hat{E}c_2$ = 2.1 kJ $\hat{E}L_2$ = 0.9 kJ
$\hat{V}_{ac}$ = 1513 volts	$\hat{V}_{ac}$ = 1513 volts

Cost		Cost	
Choke = 5382		Choke 1 = 5382	
Cap. = 5400		Choke 2 = 1100	
		Cap. 1 = 3600	
		Cap. 2 = 1680	
Cost Total:	10,782/cell	Cost Total:	11,762/cell
Cost 48 Cells:	518 k$	Cost 48 Cells:	565 k$

The additional cost to add a second harmonic to the magnet current with an amplitude of 1/8 of the fundamental and leading 1 radian with respect to the fundamental is 47 k$.

The components for this system fit in the magnet support structure.